

ENERGY ENGINEERING ANALYSIS PROGRAM

AT

NEW CUMBERLAND ARMY DEPOT, PA



VOLUME I: EXECUTIVE SUMMARY

FINAL REPORT

MARCH 1984

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UNDER

NORFOLK EEAP CONTRACT DACA-65-80-C-0014

EXECUTIVE SUMMARY

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1. INTRODUCTION

This is the Corrected Final Report on Increments A through G of the Energy Engineering Analysis Program (EEAP) at New Cumberland Army Depot (NCAD). This project has been conducted under the Norfolk District, Corps of Engineers Contract No. DACA 65-80-C-0014, by PRC Systems Services, Cocoa Beach, FL.

During Increments A and B, four modification projects were recommended for funding under the Energy Conservation Investment Program (ECIP). Increment G resulted in three recommended projects and Increment E determined the feasibility of a new, coal-fired central steam plant. Studies conducted during Increments C, D, and F concluded that none of the proposed work was economically feasible under applicable guidelines.

2. EXISTING ENERGY CONSUMPTION

Actual energy consumption at NCAD was determined from electricity billings and from fuel oil delivery records. Costs were taken from contracts and service agreements that were in force at the times the various increments were undertaken.

2.1 BASEWIDE ENERGY CONSUMPTION

Using conversion factors specified in the Army Facilities Energy Plan and prices in effect during the year, the following summarizes the total energy picture for fiscal year (FY) 83.

<u>Fuel</u>	<u>Consumption</u>	<u>Dollars</u>	<u>Source Energy Units</u>
Electricity	40,916,000 kWh	\$1,800,000	474,630 MBtu
Fuel Oil No. 2	168,122 gallons	203,500	23,320 MBtu
Fuel Oil No. 6	2,160,293 gallons	<u>1,966,000</u>	<u>323,370 MBtu</u>
		\$3,969,500	821,320 MBtu

2.2 HISTORICAL FUEL CONSUMPTION

Table 1 shows the historical record of fuel consumption from FY 75 through FY 83 and projected consumption for the future. The projection assumes that energy conservation measures recommended during this contract will have been completed and that the other factors (including base mission) remain constant.

2.3 BUILDING TYPE: SOURCE ENERGY CONSUMPTION

Buildings were grouped into 10 categories for the purpose of this study. Using FY 80 as the base year, the building groups were subjected to computer analysis to determine the relative consumption of each category. The following listing summarizes the results.

<u>Group No.</u>	<u>Title</u>	<u>Total Floor Area (sq ft)</u>	<u>1980 Consumption (Source MBtu)</u>
I	Admin, Op, Trng	365,200	34,800
II	Stor, Whse	2,467,400	210,100
III	Rec, Clubs, Centers	48,900	3,200
IV	Mess Halls, Eating Estab	30,200	4,400
V	Clinic	6,700	600
VI	Barracks, BOQ	24,400	4,500
VII	Stores, Banks, Lib, Chap, Mus	28,400	2,000
VIII	Svce Sta, Gar, Mot. P, Shops	646,400	168,500
IX	Family Housing	182,200	12,700
X	Other, Audited	81,700	15,000
-	Other, Unaudited, Fuel Oil ¹		58,900
-	Other, Unaudited, Electricity ²		261,000

¹In addition to the unaudited buildings, this item accounts for fuel oil to be saved because of base-initiated projects.

²In addition to note 1, this item includes outdoor lighting and all pumps, fans, machines, and other equipment that do not directly impact heating or cooling loads.

Table 1. Historical Fuel Consumption

NEW CUMBERLAND ARMY DEPOT

	OCT 74	NOV 74	DEC 74	JAN 75	FEB 75	MAR 75	APR 75	MAY 75	JUN 75	JUL 75	AUG 75	SEP 75	TOTAL FY 75
FUEL OIL #2 GAL	3192	24528	27888	43302	30702	21840	27090	12936	4704	7014	-0-	3318	206,514
FUEL OIL #6 GAL	196644	336924	449652	524580	422478	388416	376362	211848	89712	107688	134358	99078	3,337,740
ELECT. KWH X 10 ³	1988	2146	2268	2152	2196	2209	2072	2223	2428	2584	2493	2431	27190

	OCT 75	NOV 75	DEC 75	JAN 76	FEB 76	MAR 76	APR 76	MAY 76	JUN 76	JUL 76	AUG 76	SEP 76	TOTAL FY 76
FUEL OIL #2 GAL	8022	18312	19278	42336	35490	4364	24780	8904	3822	1092	-0-	966	177,366
FUEL OIL #6 GAL	220836	247906	474810	483084	236628	455616	385560	174846	94878	156156	104832	122640	3,207,792
ELECT. KWH X 10 ³	2403	2569	2677	2546	2608	2674	2683	2664	2966	4879	3027	2817	34513

	OCT 76	NOV 76	DEC 76	JAN 77	FEB 77	MAR 77	APR 77	MAY 77	JUN 77	JUL 77	AUG 77	SEP 77	TOTAL FY 77
FUEL OIL #2 GAL	5334	32340	30240	61530	35490	41364	24780	8904	3822	1092	-0-	966	218,862
FUEL OIL #6 GAL	234066	382242	510048	64332	443100	323232	356076	107520	66528	118482	43848	58800	3,263,274
ELECT. KWH X 10 ³	2727	3033	2858	2846	3067	2955	2821	3030	3064	3265	3235	3097	35998

Table 1. Historical Fuel Consumption (cont)

NEW CUMBERLAND ARMY DEPOT

	OCT 77	NOV 77	DEC 77	JAN 78	FEB 78	MAR 78	APR 78	MAY 78	JUN 78	JUL 78	AUG 78	SEP 78	TOTAL FY 78
FUEL OIL #2 GAL	12390	10794	37296	35070	42000	40236	16086	8610	7770	2604	1638	4158	218904
FUEL OIL #6 GAL	174466	276234	479388	418824	448896	511770	186984	142464	65646	45864	50778	57330	2,863,644
ELECT. KWH X 10 ³	2938	3133	2973	2747	3130	3022	2796	3085	3084	3471	3335	3041	36755

	OCT 78	NOV 78	DEC 78	JAN 79	FEB 79	MAR 79	APR 79	MAY 79	JUN 79	JUL 79	AUG 79	SEP 79	TOTAL FY 79
FUEL OIL #2 GAL	14322	16296	35532	30282	35742	37212	20664	3780	2898	4158	3612	9744	214242
FUEL OIL #6 GAL	188538	248892	506016	403158	490266	451290	191352	61068	53550	34818	32970	23856	2,685,774
ELECT. KWH X 10 ³	3045	3215	3135	3055	3338	3040	3110	3286	3105	3398	2846	2886	37459

	OCT 79	NOV 79	DEC 79	JAN 80	FEB 80	MAR 80	APR 80	MAY 80	JUN 80	JUL 80	AUG 80	SEP 80	TOTAL FY 80
FUEL OIL #2 GAL	2856	27342	22554	34344	39018	25326	28770	2730	3822	2394	8862	546	198534
FUEL OIL #6 GAL	114282	305592	313866	309498	444738	312186	177618	59566	38976	27300	42798	22302	2,168,722
ELECT. KWH X 10 ³	2944	2895	2994	2911	3040	3044	2930	2859	2962	3543	3173	3215	36515

Table 1. Historical Fuel Consumption (cont)

	OCT 80	NOV 80	DEC 80	JAN 81	FEB 81	MAR 81	APR 81	MAY 81	JUN 81	JUL 81	AUG 81	SEP 81	TOTAL FY81
FUEL OIL #2 GAL	4620	19194	45192	49392	39312	22680	9408	13482	8442	3570	3570	5838	224700
FUEL OIL #6 GAL	126870	253092	371616	454692	307482	277362	113778	51030	16296	31878	26040	39060	2,069,196
ELECT. KWH X 10 ³	2941	3069	3170	2931	3078	3130	2967	3204	3510	3506	3392	3354	38,252

	OCT 81	NOV 81	DEC 81	JAN 82	FEB 82	MAR 82	APR 82	MAY 82	JUN 82	JUL 82	AUG 82	SEP 82	TOTAL FY82
FUEL OIL #2 GAL	9450	18186	28224	35112	39522	28602	11130	5166	3612	2856	1638	10164	193,662
FUEL OIL #6 GAL	169554	253764	352380	427014	340620	316848	153468	41916	27846	29988	23688	30618	2,167,704
ELECT. KWH X 10 ³	3201	3456	3322	3422	3545	3384	3235	3466	3422	3491	3419	3069	40,432

	OCT 82	NOV 82	DEC 82	JAN 83	FEB 83	MAR 83	APR 83	MAY 83	JUN 83	JUL 83	AUG 83	SEP 83	TOTAL FY83
FUEL OIL #2 GAL	6510	15246	25116	26586	28182	25074	19488	5922	5166	2110	6286	2436	168,122
FUEL OIL #6 GAL	70350	361956	313110	418824	356496	322728	204792	34440	20076	18929	20235	18357	2,160,293
ELECT. KWH X 10 ³	3192	3348	3283	3393	3519	3428	3252	3430	3507	3560	3710	3294	40,916

Table 1. Historical Fuel Consumption (cont)

PROJECTED

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
FUEL OIL #2 GAL	5960	13959	22996	24342	25804	22958	17843	5924	5166	2110	6286	2436	155,784
FUEL OIL #6 GAL	56100	288572	249630	333900	284230	257280	163260	33280	19390	18280	19550	17740	1,741,212
ELECT. KWH X 10 ³	2686	2817	2762	2855	2961	2884	2736	2886	2951	2995	3121	2771	34425

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
FUEL OIL #2 GAL													
FUEL OIL #6 GAL													
ELECT. KWH X 10 ³													

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
FUEL OIL #2 GAL													
FUEL OIL #6 GAL													
ELECT. KWH X 10 ³													

2.4 TYPICAL BUILDING ENERGY CONSUMPTION

Tables 2 through 11 show the consumption of energy for heating, cooling, and lighting for individual buildings (or zones of buildings). The arrangement of the buildings is by the 10 categories listed in 2.3. (Note: Lighting energy is measured at the site; heating and cooling energy is measured at the sources.)

3. INCREMENT A - BUILDINGS AND PROCESSES

The following measures were investigated in detail during Increment A. Those in the column on the left did not meet ECIP criteria or were rejected for other reasons. Those on the right have been incorporated into one or more ECIP project packages.

Exterior Wall Insulation
Exterior Roof Insulation
Domestic Hot Water (DHW) Timeclocks
DHW Temperature Setback
Exhaust Air Heat Recovery
Outside Air Economizer

Interior Wall Insulation
Interior Roof Insulation
Ceiling Insulation
Underfloor Insulation
Basement Wall Insulation
Personnel Door Weather Stripping
Bay Door Weather Stripping
Window Treating (including
Weather Stripping)
Interior Lighting
Destratification Fans
Solar DHW
Condenser Heat Recovery
Sensible Heat Economizers
Pipe/Duct Insulation

3.1 ECIP PROJECTS DEVELOPED

The following paragraphs describe the projects that have resulted from the Increment A portion of the study. The effects of the projects are summarized in 10.

Table 2. Administration, Operations, and Training Energy Consumption

NEW CUMBERLAND ARMY DEPOT

GROUP: I TITLE: ADMIN. OP. TR

BLDG/ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION	
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	BTU PER SQ FT (X1000)
P1C	7200	FE OFFICE	129	32	17.9	18	4	2.5	35	4.9
P1D	3600	OFFICE	70	18	19.4	15	3	4.2	45	12.5
P1F	8450	GRAPHIC ARTS	554	113	65.6	297	40	35.1	230	27.2
P1H	800	SELF-SERVE OFFICE	26	6	32.5	7	1	0.8	26	32.5
P1I	21760	OFFICE	1161	307	53.4	98	25	4.5	259	11.9
P1J	640	ADP	19	4	29.7	6	1	9.4	10	15.6
P14	3968	TEL EXCH	161	47	40.6	27	6	6.0	9	2.3
P54A	39600	OFFICE	1134	316	28.6	210	52	5.3	352	0.9
P54D	31300	OFFICES	530	149	16.9	126	28	4.0	279	0.9
P54E	7500	SPEEDEX	171	34	22.8	573	70	76.4	120	16.0
P54G	13735	OFFICE	315	87	22.9	0	0	0	110	0.0
P54I	40175	OFFICE	5122	1195	127.5	294	108	7.3	429	10.7
P54J	3750	COMPUTER	66	13	17.6	72	37	19.2	57	15.2
P54K	44800	OFFICE	862	191	19.2	328	61	7.3	623	13.9
P62H	3247	OFFICE	171	45	52.7	17	6	5.2	28	8.6
P81A	3735	OFFICE	171	48	45.8	10	3	2.7	33	8.8
P81C	675	EEO	37	10	54.8	5	1	7.4	11	16.3
P81D	1500	OFFICE	92	21	61.3	4	1	2.7	13	0.7
P81E	1440	ACCTG	52	15	36.1	14	3	9.7	14	4.3
P81F	704	OFFICE	19	5	27.0	3	1	4.3	3	6.0
P81G	3520	OFFICE	129	34	36.6	18	5	5.1	24	10.0
P81I	20760	OFFICE W/OA/C	1121	316	54.0	0	0	0	371	16.0
P82D	2000	OFFICE	202	55	101.0	10	3	5.0	32	10.0
P83B	1800	OFFICE	26	7	14.4	10	3	10.0	18	0.0
P83C	2000	OFFICE	217	57	108.5	10	3	5.0	16	0.0
P84B	3168	OFFICE	369	86	116.5	105	25	33.1	249	78.6
P84D	3675	OFFICE	217	48	59.0	129	25	35.1	320	87.0
P84E	2000	OFFICE	210	56	105.0	13	3	6.5	16	0.0
P102A	653	OFFICE	16	5	24.5	0	2	12.3	26	39.8
P102B	988	OFFICE	52	15	52.6	0	0	0	62	62.0
P104	2501	PM OFFICE	97	27	38.8	12	3	4.8	5	2.0
P442	3006	INSTRUCTION	204	57	67.9	19	6	6.3	26	0.6
S269*	2340	OFFICE	95	24	40.6	0	0	0	5	2.1

Table 2. Administration, Operations, and Training Energy Consumption (Cont.)

NEW CUMBERLAND ARMY DEPOT

GROUP: I TITLE: ADMIN, OP, TR (Continued)

BLDG/ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION	
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL SITE (MEGA BTU)	BTU PER SQ FT (X1000)
S271*	4720	OFFICE-CLASS	199	45	42.2	0	0	0	27	5.7
T503*	2100	PERSONNEL	145	40	69.0	0	0	0	4	1.9
T515*	3048	ADMIN	204	62	53.0	15	3	3.9	17	4.4
T528*	2400	ADMIN	146	61	60.8	0	0	0	4	1.7
T525*	3401	ADMIN	215	40	61.8	0	0	0	8	2.3
* REPRESENTS OTHER SIMILAR BUILDINGS										

Table 3. Storage and Warehouse Energy Consumption

NEW CUMBERLAND ARMY DEPOT

GROUP: II TITLE: STORAGE, WAREHOUSE

BLDG/ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION	
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL SITE (MEGA BTU)	BTU PER SQ FT (X1000)
P1B	100,620	STGE/SHOPS	8592	2308	85.4	0	0	0	488	4.8
P2*	203,021	WUSE	5602	1092	27.6	0	0	0	1263	6.2
P6	203,021	WUSE	2927	1252	14.4	0	0	0	1263	6.2
P7	181,226	WUSE	31693	6403	174.9	0	0	0	1041	5.7
P84A	196,832	STORAGE	21465	5978	109.1	0	0	0	7773	39.5
P85A	115,182	STORAGE	21895	5566	190.1	0	0	0	1822	15.8
*REPRESENTS	OTHER SIMILAR BUILDINGS									

Table 4. Theaters, Clubs, Recreation Centers, and Bowling Energy Consumption

NEW CUMBERLAND ARMY DEPOT

GROUP: III TITLE: THEATRES, CLUBS, RECREATION CENTERS, BOWLING

BLDG/ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION	
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL SITE (MEGA BTU)	BTU PER SQ FT (X1000)
P79A	7500	OFF MESS BALLROOM	202	53	26.9	31	4	4.1	7	0.9
S252	3933	THEATRE	195	52	49.6	15	3	3.8	2	0.5
S259A	1404	CERAMIC SHOP	74	18	52.7	0	0	0	6	4.3
S259B	1073	PHOTO LAB	49	12	45.7	4	1	3.7	2	1.9
S261*	3883	BOWLING	209	50	53.8	10	6	4.6	15	3.9
S270A	8220	WOOD SHOP	238	58	28.9	0	0	0	11	1.3
T105	5449	CLUB	280	69	51.4	0	0	0	20	3.7
T459	11347	GYM	779	197	68.7	0	0	0	125	11.0

* REPRESENTS OTHER SIMILAR BUILDINGS

Table 5. Mess Hall, Snack Bar, Cafeteria, and Restaurant Energy Consumption

NEW CUMBERLAND ARMY DEPOT

GROUP: IV TITLE: MESS HALL, SNACK BAR, CAFETERIA, RESTAURANT

BLDG/ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION		
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	BTU PER SQ FT (X1000)	
P54F	5865	CAFETERIA	162	44	27.6	130	22	22.2	214	36.4	
P62A	3544	RESTAURANT	713	189	201.2	63	23	17.8	40	11.3	
P79B	4752	OFF MESS	63	19	13.3	47	8	9.9	61	12.8	
P79C	1974	O. MESS-KITCHEN	346	92	175.2	0	0	0	70	39.5	
P81H	4040	RESTAURANT	136	44	33.7	31	6	7.7	15	3.7	
P400B	4944	MESS	665	170	134.5	0	0	0	5	1.0	
T244A	2050	BAR	113	29	55.1	25	5	12.2	13	6.3	
T244B	3040	OPEN MESS	62	14	20.3	209	43	94.8	31	10.2	

Table 6. Clinic Energy Consumption

NEW CUMBERLAND ARMY DEPOT

GROUP: V TITLE: CLINIC

BLDG/ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION	
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL SITE (MEGA BTU)	BTU PER SQ FT (X1000)
1524	6676	CLINIC	353	92	52.9	25	0	3.7	60	9.0

Table 7. Barracks and BOQ Energy Consumption

NEW CUMBERLAND ARMY DEPOT

GROUP: VI TITLE: BARRACKS, BOQ

BLDG/ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION	
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL SITE (MEGA BTU)	BTU PER SQ FT (X1000)
P400A S260	10095	BARRACKS BOQ	1555	372	154.0	0	0	0	543	53.0
	14276		359	93	25.1	0	0	0	229	16.0

Table 8. Stores, Banks, Library, Chapel, and Museum Energy Consumption

NEW CUMBERLAND ARMY DEPOT

GROUP: VII TITLE: STORES, BANKS, LIBRARY, CHAPEL, MUSEUM

BLDG./ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION	
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL SITE (MEGA BTU)	BTU PER SQ FT (X1000)
PIA P406 52708	22400	COMMISSARY PKG LIQUOR COMMISSARY	797	190	35.6	69	22	3.1	212	9.5
	1800		97	30	53.9	7	2	3.9	11	6.1
	4160		130	31	31.3	26	5	6.3	44	10.6

Table 9. Gas Station, Garage, Motor Pool, and Shops Energy Consumption

NEW CUMBERLAND ARMY DEPOT

GROUP: VIII TITLE: GAS STATION, GARAGE, MOTOR POOL, SHOPS

BLDG/ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION	
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL SITE (MEGA BTU)	BTU PER SQ FT (X1000)
P1G	56830	WOOD SHOPS	4756	1320	83.7	0	0	0	540	9.5
P2B*	12288	MOTOR SHOPS	2823	721	230.6	0	0	0	213	17.3
P02A	159760	SHOP	45856	9298	287.0	0	0	0	2378	51.9
P02C	80000	SHOP	9292	2546	116.2	0	0	0	2008	36.1
P03A	205367	SHOP	23671	6402	115.3	0	0	0	7069	34.4
P05B	11118	POL LAB	622	136	55.9	252	47	22.7	83	7.5
P05C	78353	SHOP	20544	4324	262.2	0	0	0	1562	19.9
P07	4614	MNT SHOP	1497	290	324.4	0	0	0	139	30.1
P08	35015	IIANGAR	6572	1420	187.7	0	0	0	342	9.8

* REPRESENTS OTHER SIMILAR BUILDINGS

Table 10. Family Housing Energy Consumption

NEW CUMBERLAND ARMY DEPOT

GROUP: IX TITLE: FAMILY HOUSING

BLDG./ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION	
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ. FT. (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ. FT. (X1000)	TOTAL ANNUAL SITE (MEGA BTU)	BTU PER SQ. FT. (X1000)
P30	2460	SINGLE	139	38	56.5	0	0	0	0	3.3
P31*	3647	DUPLEX	190	46	52.1	0	0	0	6	1.6
P40*	3780	DUPLEX	164	40	43.4	0	0	0	14	3.7
P133*	9559	MULTI	455	107	47.6	56	19	5.9	41	4.3
P164*	1813	SINGLE	116	27	64.0	0	0	0	9	5.0
P187*	2518	DUPLEX	171	40	67.9	15	6	6.0	6	2.4
* REPRESENTS OTHER SIMILAR BUILDINGS										

Table 11. Other Energy Consumption

NEW CUMBERLAND ARMY DEPOT

GROUP: X TITLE: OTHER

BLDG./ZONE	FLOOR AREA	USE	HEATING CONSUMPTION			COOLING CONSUMPTION			LIGHTING CONSUMPTION		
			TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL (MEGA BTU)	PEAK MONTH (MEGA BTU)	BTU PER SQ FT (X1000)	TOTAL ANNUAL SITE (MEGA BTU)	BTU PER SQ FT (X1000)	
P54B	1200	COMM CENTER	14	4	11.7	206	23	171.7	36	30.0	
P54C	10000	COMPUTER	0	0	0	2096	103	209.6	299	29.9	
P54H	3675	WD PROC	37	10	10.1	21	4	5.7	23	6.3	
P81B	750	CONF ROOM	148	37	197.3	4	1	5.3	9	12.0	
P1E	1650	OFFICE	67	16	4.0	12	3	7.3	26	15.6	
P84C	1000	OFFICE	5	2	2.0	60	11	33.3	144	80.0	
P82B	240	BEARING ROOM	92	17	383.3	28	8	116.7	8	33.3	
P85D	1647	BONDING ROOM	0	0	0	32	6	19.4	44	26.7	
P92	5560	MNT SHOP	4957	870	891.5	0	0	0	141	25.4	
P21	55200	LAUNDRY	3013	761	54.6	0	0	0	497	9.0	

3.1.1 ARCHITECTURAL/STRUCTURAL MODIFICATIONS. Work will consist of the following modifications to achieve improved energy conservation:

a. Wall Insulation.

- (1) R9 spray cellulose on buildings P1, P6, P7, P24, P28, P82, P83, P84, P85, and P88
- (2) R11 F/G batts on buildings P14, P54, P83, P84, P400, T526, and T528
- (3) R13 F/G batts on buildings P1, P62, P82, P83, P84, and P104
- (4) R17 F/G batts on buildings P79, P81, P102, P400, T524, and T526
- (5) R15 F/G batts on building P104

b. Ceiling Insulation.

- (1) R15 lay-in F/G batts in buildings P1, P83, and P84
- (2) R11 lay-in F/G batts in buildings P54, P79, P81, P83, P84, P85, and P400
- (3) R9 lay-in F/G batts in building P81
- (4) R13 lay-in F/G batts in building P104
- (5) R9 spray cellulose with mesh in building P28
- (6) R15 spray cellulose with mesh in building P7
- (7) R17 spray cellulose with mesh in buildings P1, P82, and P85

c. Floor Insulation.

- (1) R7 spray cellulose with mesh in building P400

(2) R11 spray cellulose with mesh in building P102

d. Weather Stripping. Doors in buildings P62, P81, P82, P83, P84, P85, P102, P442, and S268

e. Destratification fans in buildings P1, P2, P3, P4, P5, P7, P8, P28, P50, P51, P52, P53, P82, P83, P84, P85, P88, P400, S252, and T459

f. Window Treatment.

(1) R19 spray cellulose with mesh in buildings P1, P24, P28, P82, P83, P84, P85, and P88

(2) R14 insulated curtains in buildings P1, P14, P79, P81, P82, P83, P84, P88, P102, P244, P400, P442, T244, and T524

(3) Storm windows in building P1

(4) R19 dryvit panels in building T459

g. Lighting Modifications.

(1) Incandescent to high-pressure sodium in buildings P2, P3, P4, P5, P6, P8, P50, P51, P53, and P88

(2) Mercury vapor to high-pressure sodium in buildings P82, P83, P84, and P85

h. The terms dryvit, F/G, and fiberglass are used to describe a type of product. They are not intended to be exclusive of other similar products.

3.1.2 SOLAR DHW HEATERS IN FAMILY HOUSING. Work will consist of installation of solar DHW heaters and appropriate plumbing and instrumentation in family housing. In addition, for buildings in the 130, 160, and 180 series, a small weatherproof cover will be constructed to house the new hot water tank.

3.1.3 HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC) SYSTEMS MODIFICATIONS.

- a. Building P1 - Section I Commissary: Refrigeration System Heat. This change consists of modifying the freezer refrigeration condenser cooling water system. The water will be piped to a heating coil in the existing air handler in parallel to the existing water cooling tower. A new control circuit with a heating/cooling thermostat will be required to interlock and sequence the air handler with the freezer refrigeration system. The heat that is presently wasted will be reclaimed in the air supplied to heat the buildings.
- b. Building P54 - Computer Air-Conditioning Units: Liquid Sensible Heat Recovery. This change applies to each of seven computer air-conditioning units that utilize glycol/water as the heat transport medium for the refrigeration condenser. A precooling coil will be installed with piping to connect it in parallel with the existing glycol/water cooled condenser. Controls and valves will be required to allow the coil to augment the cooling provided by the existing refrigerant coil during mild weather. In cold weather, the refrigeration system will be shut down with 100 percent of the computer cooling load handled by the glycol/water cooling coil.

4. INCREMENT B - UTILITIES, DISTRIBUTION SYSTEMS, AND ENERGY MONITORING AND CONTROL SYSTEM (EMCS)

The following measures were studied in some detail during Increment B:

- o Exterior lighting improvements
- o Steam/condensate system improvements
- o Electricity distribution system improvements
- o EMCS expansion

4.1 ECIP PROJECT DEVELOPED

This paragraph describes the only project that resulted from the Increment B portion of the study. The effect of the project is summarized in 10.

4.1.1 MODIFICATIONS OF EMCS. Expand EMCS to include eight additional buildings to control and minimize energy consumption. Useful management data will also be reported to reduce manual requirements and report malfunctions. Buildings affected by this project are P7, P62, P88, P244, P260, P261, P270, and T524.

5. INCREMENT C - RENEWABLE ENERGY SOURCES: SOLAR AND BIOMASS

The feasibility of utilizing solar energy to supplement DHW heating, space heating, and a combination of water and space heating was analyzed during Increment C. No project in either the sample support building or in the sample family housing building proved acceptable under Increment C guidelines.

In the biomass portion of Increment C, the present economic viability of wood chips as a substitute fuel was determined. However, because of the uncertainty of supply and the potential volatility of the price, conversion to biomass as the primary fuel was not recommended. There are no other potential sources of renewable energy at NCAD.

6. INCREMENT D - COGENERATION

Four different steam pressure/temperature situations were analyzed in order to determine the feasibility of electric cogeneration. In each case, a superheater was required and outlet steam conditions had to be equivalent to current heating system supply conditions. In none of the cases was the life cycle cost as low as that of the status quo.

7. INCREMENT E - CENTRAL BOILER PLANT PROJECTS

Since NCAD already has a central boiler plant, this increment concentrated its analysis on conversion to coal and the potential boiler size configuration. As

a result, a five-boiler coal- and wastewood-firing configuration was recommended utilizing the existing steam distribution system.

8. INCREMENT F - FACILITIES ENGINEER CONSERVATION MEASURES

The scope of work specific for Increment F called for analysis of three potential energy conservation projects: resizing oil burner nozzles, rezoning building 1-1, and rezoning buildings 82, 83, 84, and 85. Only a portion of the last project was recommended for implementation; however, mission changes in the interim have eliminated the need to rezone. In building 1-1, the sources of the problems that led to the rezoning idea were uncovered during the field survey and appeared to be correctable without major expense.

9. INCREMENT G - NONQUALIFIED INCREMENTS A AND B PROJECTS

Several projects that were originally considered under Increment A were re-analyzed under this increment. Those projects that are acceptable under Increment G criteria are described in the following paragraph. The effects of the projects are summarized in 10. One additional project, outside air economizers in buildings 1, 54, and 81, was rejected again.

9.1 INCREMENT G PROJECTS DEVELOPED

9.1.1 WEATHERIZATION AND LIGHTING MODIFICATIONS. Work will consist of the following modifications to improve energy conservation:

a. Interior Wall Insulation.

(1) R7 spray cellulose in building P87

(2) R9 spray cellulose in building P92

b. Roof Insulation. R19 interior spray cellulose in buildings P87 and P92

c. Window Insulation. R19 interior spray cellulose in buildings P87 and P92

d. Replace fluorescent lighting with high-pressure sodium in building P92

9.1.2 INSULATE STEAM LINES TO $U = 0.1$. The project will consist of gaining access to all steam lines and insulating them to a U-factor of 0.1. Sump pumps will be installed in all pits, and manholes will be installed to protect insulation from water damage. Surroundings will be returned to their original state.

9.1.3 WEATHERIZATION FOR FAMILY HOUSING. Work will consist of the following modification to improve energy conservation: automatic nighttime setback thermostats in buildings P30, P40, P41, P133-144, P164-171, and P187-197.

10. ENERGY PLAN

In FY 83, NCAD consumed 821,320 MBtu's of energy at a cost of nearly \$4 million. Implementation of all recommended projects except Increment E would reduce this consumption to 681,581 Btu's, which would cost \$3,288,000 at today's prices. Table 12 summarizes the recommended EEAP projects.

10.1 ENERGY USAGE PER SQUARE FOOT

The total area of buildings at NCAD is 3.93 million ft^2 . Warehouses account for 2.47 million of this or 63 percent. On a gross basis, the consumptions in Btu's in FY 83 and after implementation of recommended projects are:

	<u>FY 83</u>	<u>Future</u>	<u>Δ</u>
Electricity	120,770 Btu/ ft^2	101,610 Btu/ ft^2	19,160 Btu/ ft^2
Fuel Oil No. 2	5,933 Btu/ ft^2	5,498 Btu/ ft^2	435 Btu/ ft^2
Fuel Oil No. 6	<u>82,284 Btu/ft^2</u>	<u>66,321 Btu/ft^2</u>	<u>15,963 Btu/ft^2</u>
	208,987 Btu/ ft^2	173,429 Btu/ ft^2	35,558 Btu/ ft^2

This represents an overall reduction of over 17 percent in total energy consumption.

Table 12. EEAP Project Summary

Project	Increment	DD 1391 Information					Energy Savings			
		Project Year	CWE \$1,000	E/C	B/C	P/B	F0 #2	Gallons F0 #6	kWh Electricity	Total MBtu
Architectural/Structural/ Lighting/De-stratification Modifications	A	1984	6,047	18.8	6.0	2.2	4,376	312,118	5,704,483	113,500
Solar Assisted DHW	A	1984	1,089	3.3	0.3	21.0	0	0	306,293	3,553
HVAC Systems Mods	A	1984	214	17.5	2.2	10.1	0	4,147	268,664	3,737
Expand EMCS	B	1984	178	35.1	4.1	3.4	0	28,018	178,190	6,261
Weatherization and Lighting Modifications	G	1984	43	15.3	4.1	3.5	0	1,747	33,414	649
Insulate Steam Lines	G	1984	1,282	8.5	2.0	11.7	0	73,051	0	10,935
Weatherization for Family Housing	G	1984	18	63.1	12.7	1.1	7,962	0	0	1,104
Totals							12,338	419,081	6,491,044	139,739

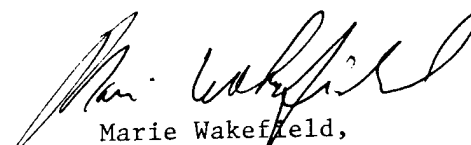


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